



Pollution Prevention

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What is Pollution Prevention?

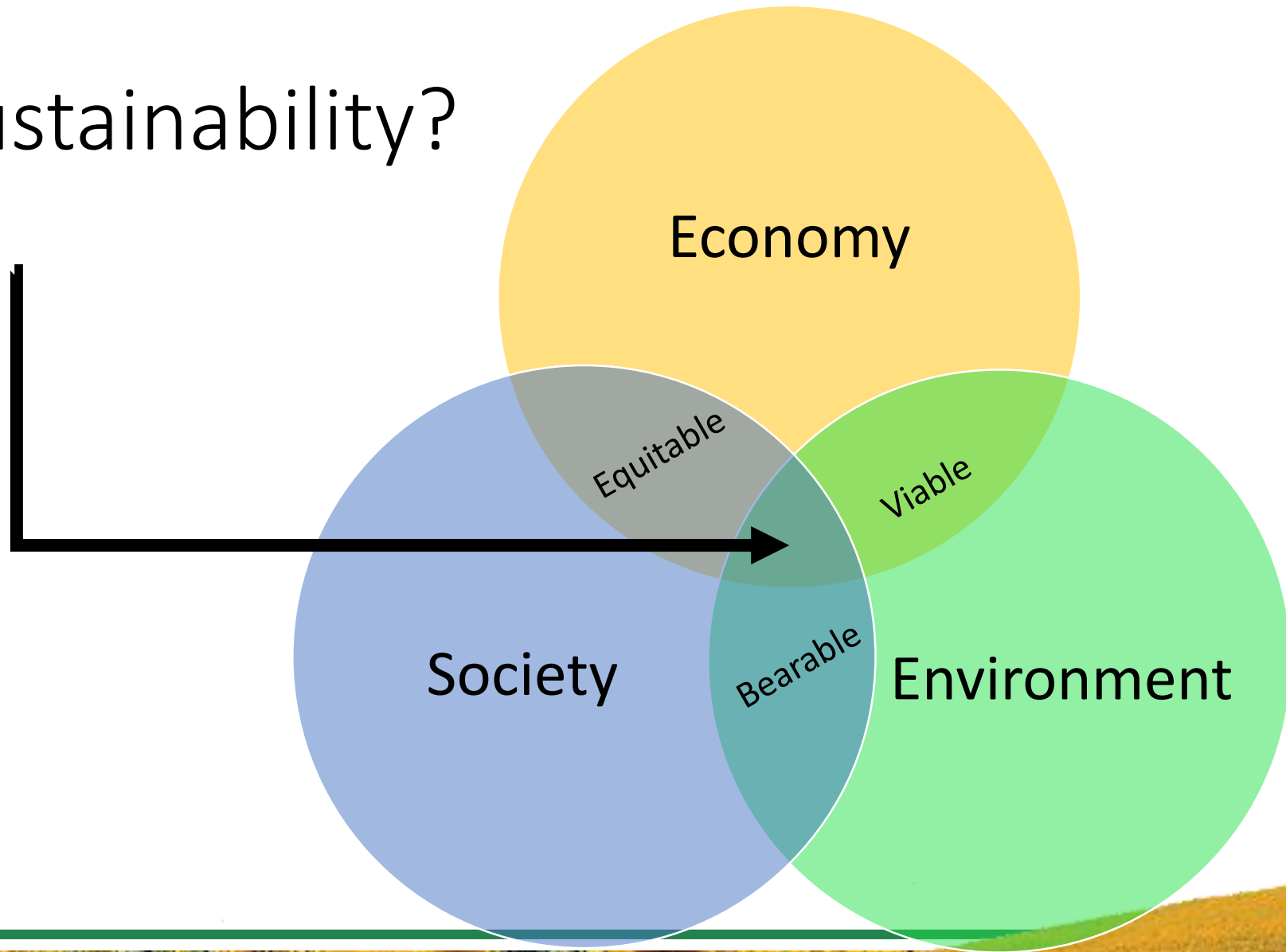
The connection between health, safety, sustainability and resilience.



What is your favorite music?

Start the presentation to see live content. Still no live content? Install the app or get help at PollEv.com/app

What is sustainability?



Sustainability

- Commonly **defined** as the ability to maintain or improve standards of living without damaging or depleting natural resources for present and future generations—was ingrained as a foundation of environmental law with the signing of the 1969 National Environmental Policy Act. Jun 26, 2018



Source: <https://www.epa.gov/sustainability>



Resilience

- Resilience can be **defined** as the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.
- Community resilience is the ability to prepare for anticipated hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. Activities, such as disaster preparedness—which includes prevention, protection, mitigation, response and recovery—are key steps to resilience. [<https://www.nist.gov/topics/community-resilience>]



Let's take a "walk" back into time.....





What is “Pollution”?

Any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions and accidental releases).

Hazards of concern for workplace employee exposure can be abated through pollution prevention.

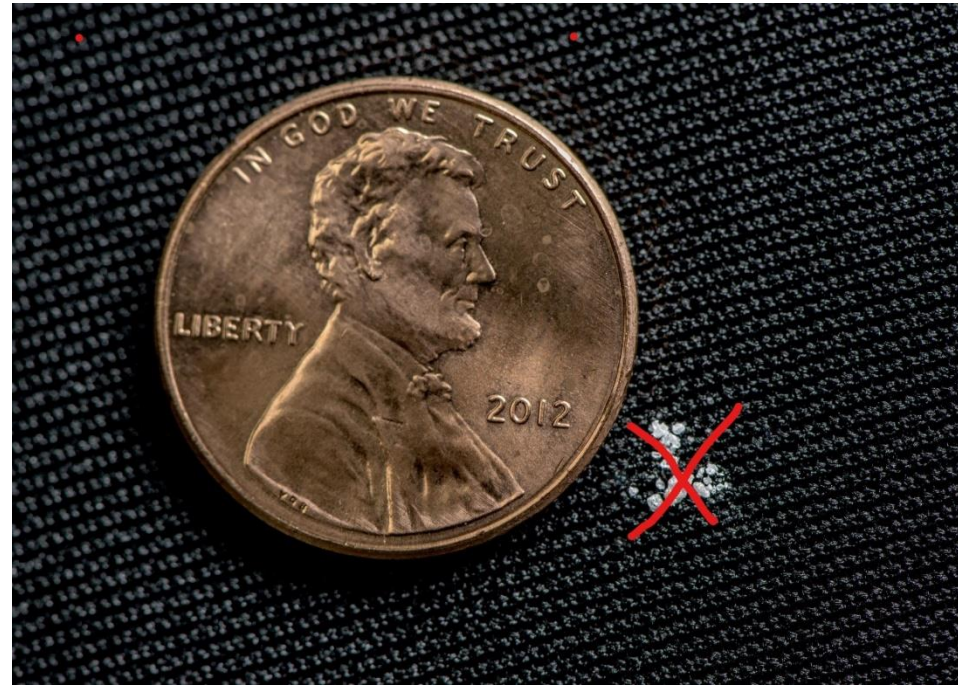


The Solution to Pollution is.....

Dilution – what is 1 part per million?



Reduce or Eliminate – YES!



<https://www.dea.gov/galleries/drug-images/fentanyl>



The Pollution Prevention Act

***United States Code, Title 42 The Public Health And Welfare,
Chapter 133 Pollution Prevention***

The Pollution Prevention Act of 1990 establishes a national policy that U.S. EPA implements:

“The Congress hereby declares it to be the national policy of the United States that **pollution should be prevented or reduced at the source whenever feasible**;

Pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible;

Pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible;

Disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.”



Pollution Prevention

Any practice which:

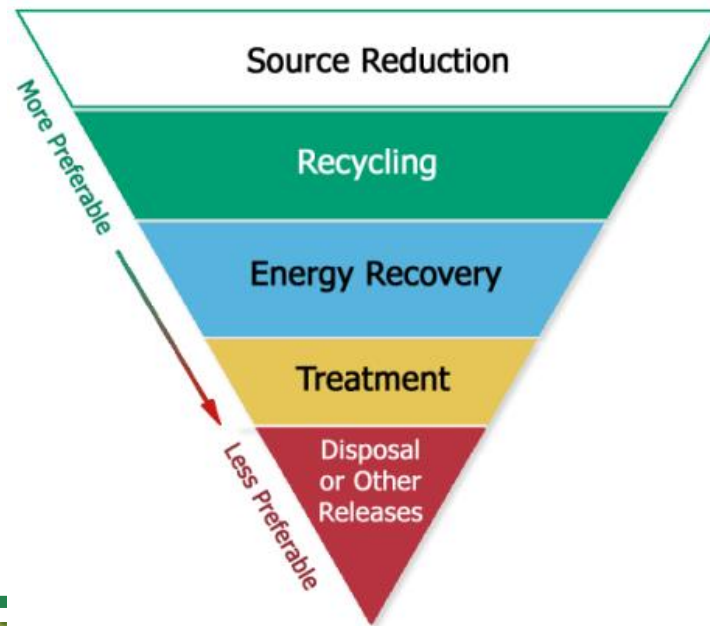
- reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions and accidental releases) prior to recycling, treatment, or disposal, and reduces the hazardous to the public and the environment associated with the release of those substances, pollutants, or contaminants.
- P2 practices can include:
 - Equipment or technology modifications
 - Process or procedure modifications
 - Reformulation or redesign of products
 - Substitution of raw materials
 - Improvements in housekeeping, maintenance, training or inventory control
 - Increased efficient use of water , energy , raw materials, or other resources, including conservation methods



P2=Source Reduction

Pollution prevention (P2) is any practice that reduces, eliminates, or prevents pollution at its source, also called “Source Reduction,” rather than trying to control or dispose of it afterwards.

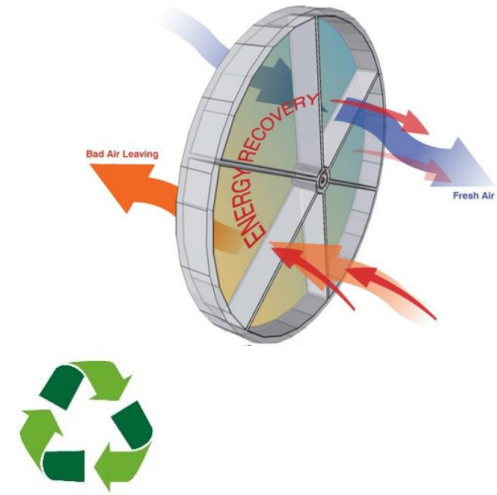
The EPA Waste Management Hierarchy



What P2 Does NOT Include

Pollution prevention does NOT include:

- Energy recovery
- Treatment of a waste stream
- Disposal
- Recycling
- Any practice that alters a hazardous substance, pollutant, or contaminant once it is generated
- A practice that is not necessary for production
- Practices that create new risks to human health or the environment



Which of the following would not be pollution prevention?

Switching from a highly toxic chemical to a less toxic chemical.

Right-size a boiler for the steam needs of the process.

Install a solvent distillation unit to recover and reuse spent solvent.

Collect plastic, cardboard and paper and recycle.

Why Do P2?

Pollution prevention is about increasing operational efficiencies, reducing risk, and effectively meeting environmental responsibilities.



Unlike most pollution control strategies, P2 offers important **economic, regulatory, environmental, and social benefits** that can often result in a more competitive business.



The P2 Process – Step 1

Sound reasons to implement P2:



- Reduced waste generation/waste treatment and disposal costs
- Reduced raw material consumption/material costs
- Reduced potential liability
- Improved regulatory compliance
- Improved public relations
- Enhanced process efficiency resulting in improved company profits
- Improved staff productivity

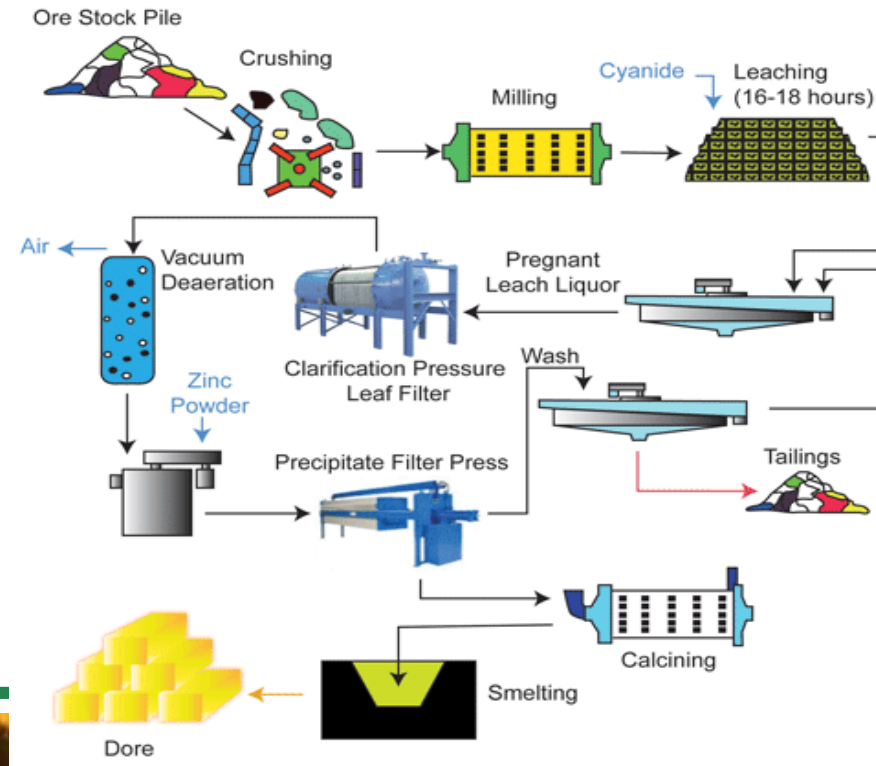


The P2 Process – Step 2

Analyze
the Process
& Develop a
Baseline

- ❑ Create a general process flow diagram (map) for the entire facility and detailed maps for each process (systematical assessment).

- ❑ Determine where materials are used and waste is generated.



The P2 Process – Step 2 (cont.)

Analyze
the Process
& Develop a
Baseline

Create detailed itemizations to clarify processes and establish baselines for:

- ❑ **Materials** – Raw materials used (natural and process), source(s) of raw materials, procurement practices, full costs
- ❑ **Work Practices** – Moment-by-moment actions, routes, interrelated activities, dependencies between applications, full costs
- ❑ **Waste Generation** – Process waste, quality control waste, cleanup waste, full costs
- ❑ **Waste Disposal Practices** – Handling, storage, treatment, recycling, transport, final disposal methods, spills and releases, full costs



The P2 Process – Step 2 (cont.)

Analyze
the Process
& Develop a
Baseline

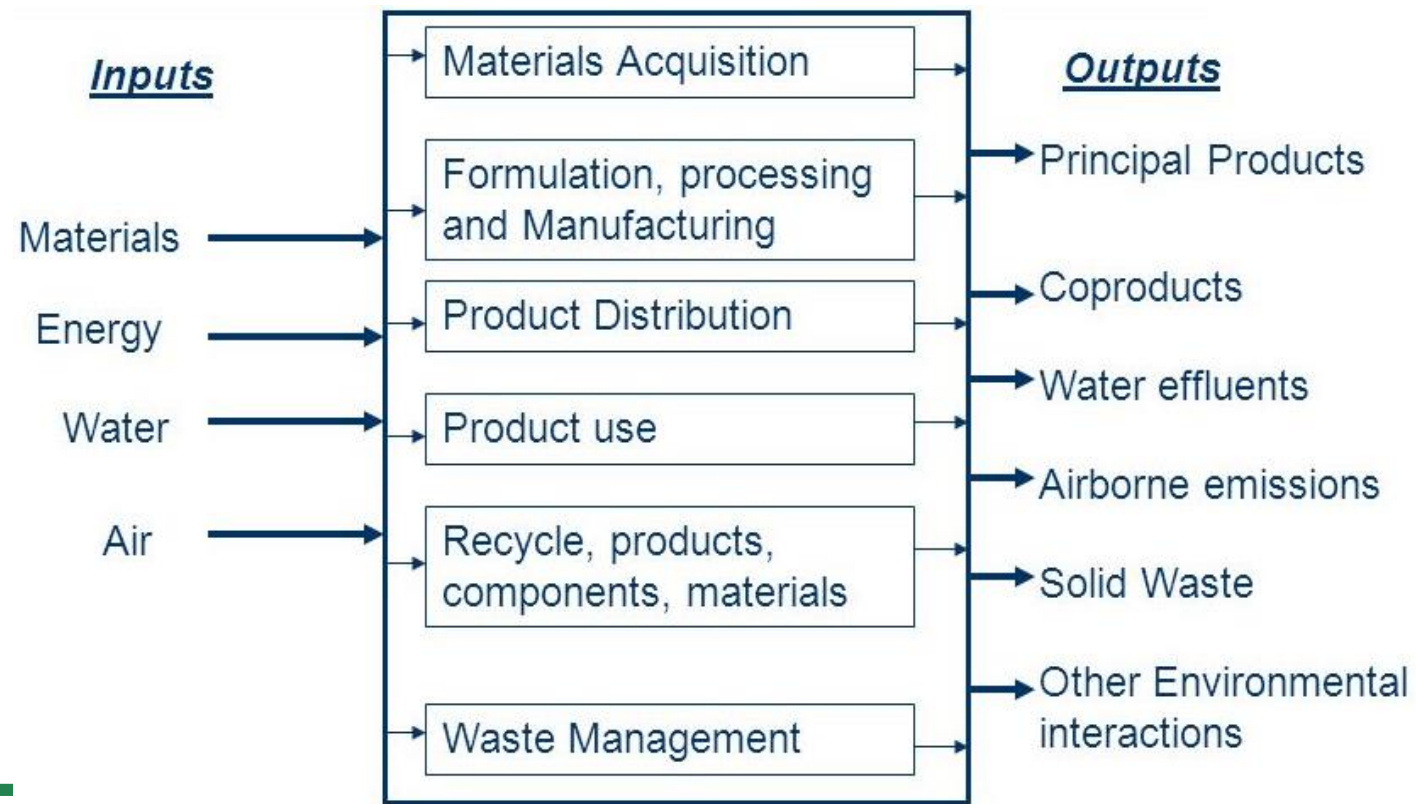
Consider conducting a **Life Cycle Inventory** (LCI) analysis. LCI is a thorough procedure accounting for the environmental loads during the product's life cycle. It is intended to be a “cradle-to-grave” approach and associates a “full cost accounting” from product manufacturing.



The P2 Process – Step 2 (cont.)

Analyze
the Process
& Develop a
Baseline

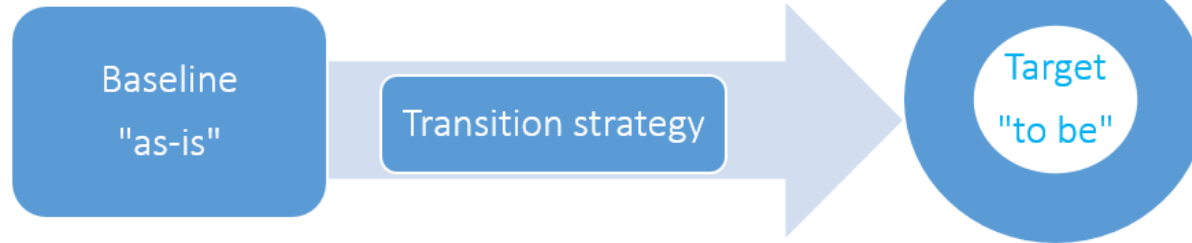
Life Cycle Inventory Analysis



The P2 Process – Step 2 (cont.)

Analyze
the Process
& Develop a
Baseline

Use this information to select
a focus for a P2 project.



Consider concentrating on reducing wastes (**emissions**)
that fit any of these criteria:

- Has the greatest negative impact (environmental or human health - **worker and community exposures**)
- Is generated from expensive raw materials
- Requires specialized handling methods
- Is considered to be hazardous or regulated
- Is costly to dispose of
- Is easy to reduce



The P2 Process – Step 3

Identify
Pollution
Prevention
Opportunities

- ❑ Identify operations or processes where implementing P2 practices are possible – Use baselines to identify targets.
- ❑ Hold a brainstorming session – Include representation from all levels of the organization.



The P2 Process – Step 3 (cont.)

Identify
Pollution
Prevention
Opportunities

- ☐ Examine obvious waste reduction measures.
- ☐ Target and characterize problem waste streams.
- ☐ Develop long-term waste reduction alternatives.
- ☐ Consider a range of pollution prevention techniques – Use information sources, data systems, and technical assistance services to generate ideas.





The P2 Process – Step 3 (cont.)

Consider the following “P2 mantra” for each target area:

- ☐ **Change the material**
 - ☐ Input raw material modification/substitution
 - ☐ Product reformulation
- ☐ **Change the process**
 - ☐ Production unit/equipment redesign, modification, or modernization
 - ☐ Production process changes/process optimization
- ☐ **Change the technology**
 - ☐ In-process (integral) recycling/reuse, or closed loop systems
 - ☐ Packaging, shipping, and container changes



P2 Strategies

Many P2 efforts are inexpensive and simple to implement, often involving only a change in attitude or work procedures.

Commonly used methods of P2 include some of the following approaches:

- ☐ Modifying production processes to produce less waste
- ☐ Using nontoxic or less toxic chemicals as cleaners, degreasers, and other maintenance chemicals



P2 Strategies (cont.)

- ☐ Implementing water conservation practices by reducing the use of water and chemical inputs to water
- ☐ Implementing energy conservation practices by increasing energy efficiency and decreasing energy use
- ☐ Use of environmentally benign fuel sources
- ☐ Conducting key maintenance activities regularly
- ☐ Implementing in-process recycling
- ☐ Reducing the amount of packaging
- ☐ Purchasing durable, long-lasting materials
- ☐ Reusing materials such as drums and pallets rather than disposing of them as waste



P2 Strategies

Input Substitution (change the material)

- Changing a raw material to something less toxic (e.g., Toluene in spray painting)
- Low VOCs, metals
- MIT EHS Green Chemical Alternatives Purchasing Wizard
<http://ehs.mit.edu/site/content/green-chemical-alternatives-purchasing-wizard>
- Toxic Use Reduction Institute CleanerSolutions Database
<http://www.cleansolutions.org/>



P2 Strategies

Process Modification (change the process and material)

Chemical	Current	Advanced	Advantages
Cleaner	Gardoclean® S 5219: Alkaline cleaner containing non-biodegradable petroleum-based surfactants.	<i>Environmentally friendly</i> Cryscosat® 2707: 1) Employs acidic system containing bio-degradable non-petroleum-based surfactants, and	1) Eliminates one chemical, & uses less chemical overall, 2) reduces heat to Stage 1 and eliminates heat to Stage 3, reducing energy costs,
Conversion coat	Cryscosat® 2147	2) Combines cleaning & conversion coating within same chemical package, eliminating 1 chemical.	3) has neutral-pH discharge, easing load to municipal water treatment facilities, 4) is more simple to operate & maintain and has less chance for operator error.
Seal	Gardolene® D 6871: Contains biocide for bacteria control.	Gardolene® D 6810: No biocide needed .	5) Has no bacteria and no need for biocide, eliminating operator exposure to dermatitis.



P2 Strategies

Equipment Modification

- Food manufacturer
- Water conservation initiative



P2 Strategies

Product packaging

- Yellow+Blue wines –
<https://www.entrepreneur.com/article/219670>
- Lighter coke bottles -
http://www.enn.com/top_stories/article/22686

What type of strategy is this? Material, process or technology?

What are the secondary savings?

What the impact of bottled water?





P2 Strategies

Raw Material Use & Handling

A change to a process to incorporate recovery and/or reuse of a raw material

Material Tracking & Inventory Control

- first-in, first-out
- just-in-time manufacturing



P2 Strategies

Improved Housekeeping & Maintenance

- Dry cleaning instead of wet cleaning
- Compressed air audits and repair
 - Load-sharing on compressors
 - Restricting air pressure in certain areas of the plant
 - Check leaks from pressurized product tanks – welding gases



**Name a process or operation in your operations that could
be reviewed for possible pollution prevention
improvements:**

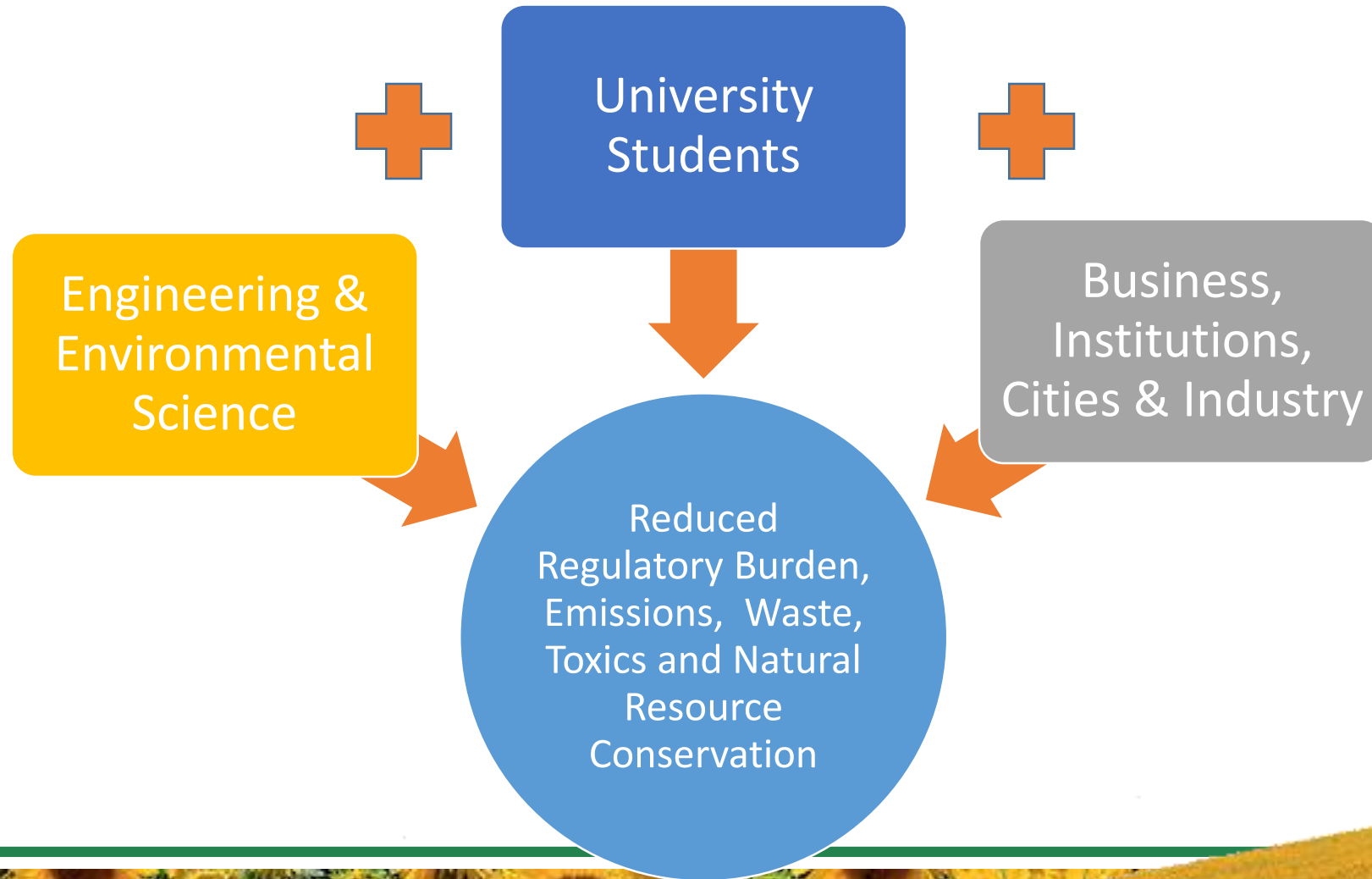


Pollution
Prevention
Institute

Pollution Prevention (P2) Intern Program



Purpose



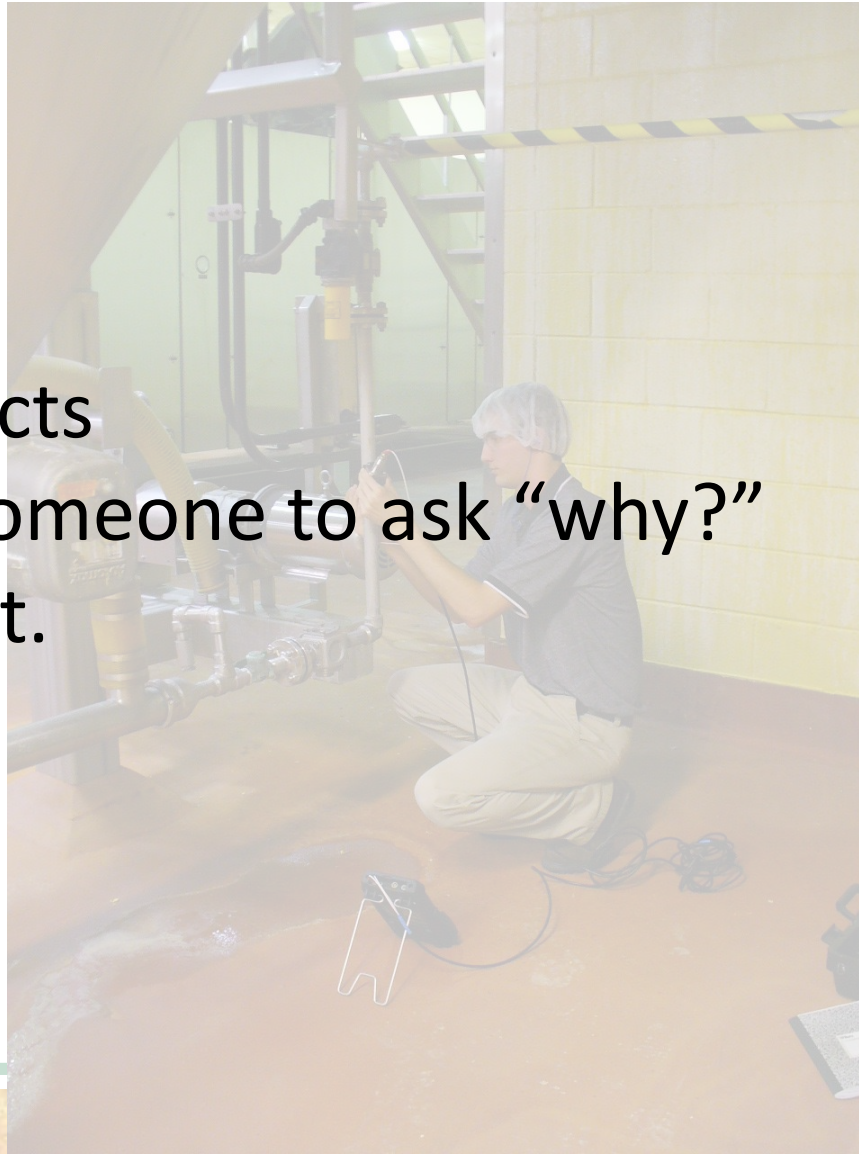
Interns

- Junior level or higher, engineering and environmental science students
- From accredited universities and colleges in Kansas
- 10-weeks on-site*
- One week training by KSU PPI Staff and Guest Professionals from Industry
- **Shorter internships available in select situations*



Why interns?

1. Time to tackle projects
2. Fresh pair of eyes/someone to ask “why?”
3. Gives a place to start.



Host Companies

*companies participating multiple years

Advantage Metal Recycling

Associated Purchasing Services

Associated Wholesale Grocers

Bombardier Learjet

Biosecurity Research Institute

Capstan Ag, Inc.

CertainTeed

CFS Holdings*

Coleman Company, Inc.*

Columbian Chemical Company

Compass Minerals*

CST Storage*

Deffenbaugh Industries

Dillons Food Stores*

Florence Manufacturing

Frito-Lay*

Frontier El Dorado Refining Co.

Gates Corporation*

Grandview Products*

GTM Sportswear

Haldex Brake*

Hallmark Cards

Henke Manufacturing*

Johnson Controls Inc.

Johnson Co. Community College

Johnson Co. Dep. Health/Env.

Kansas Army National Guard

Kansas State University

Kickapoo Tribe

Madonna Rehab. Hospital

Mercy Regional Health Center*

The Monarch Cement Company

Philips Lighting

Prairie Band Potawatomi Nation

Robbie Fantastic Flexibles

Schwan's Global Supply*

Smithfield Foods*

SPX Cooling Technologies Inc.

Superior Essex

Tyson Fresh Meats, Inc.

Unilever Foodsolutions

VA Eastern KS Healthcare System

Via Christi*

Webco Manufacturing, Inc.

Wolf Creek*

and others



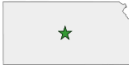
Case Summaries – 2006 to Current

Researching reduction in water to Class I well disposal – Compass

2019 Case Study

COMPASS MINERALS

Intern: Isaac Wright
Major: Biological Systems Engineering
School: Kansas State University



Company Background

Compass Minerals is a publicly traded company (CMP on NYSE) with a 2018 revenue of 1.5 billion dollars. Products produced by Compass Minerals include food-grade salt, water-conditioning products, various de-icing products and plant nutrients. With a robust corporate responsibility policy and yearly sustainability reports, Compass Minerals continues to be a leader in environmental stewardship for the natural resource industry. The Lyons evaporation plant utilizes mechanical evaporation to separate salt from highly concentrated brine. The plant produces around 1,000 tons of salt per day to meet product demands. Products produced at the Lyons facility include food-grade salt both bagged and bulk, salt and mineral products for livestock, water-conditioning products, and bulk -treated and untreated salt for industry users.

Project Background

Compass Minerals is in the midst of remediating two historical chloride plumes and currently sends approximately 524 million gallons of water to Class 1 disposal wells. Recognizing the need to conserve water and preserve pore space in the Arbuckle formation, Compass is pursuing opportunities to divert water from Class 1 disposal. Compass Minerals is also looking to reduce freshwater intensity on site by reducing wastewater

to Class 1 wells. Non-hazardous waste is the target for volume reduction. Any new permit or renewal of a Class 1 disposal well must be accompanied with a volume-reduction plan or study. Before the next Class 1 re-permit application is due, Compass Minerals will need to have a volume-minimization program/study in place. In addition to disposal minimization, Compass Minerals is looking to reduce both freshwater intensity at all sites by 5% and greenhouse gas emissions by 7% by 2020.

Projects Reviewed for P2 potential.

Drinking fountain installation

Two continuous-flow drinking fountains currently exist in the plant. They run at a combined 3.5 GPM for a yearly water use of more than 1.84 million gallons. They are in inconvenient locations and rarely used by workers. The intern identified two locations for traditional hi-low water fountains that will reduce water usage by 1.7 million gallons per year and reduce 4.1 MTCO₂e. In addition to environmental considerations, the new fountains will save at least \$4,600 per year in water cost.

Daily well route adjustment

Brinefield employees perform daily rounds to check remediation wells not essential for salt production. It takes nearly 30 minutes a day to drive to wells F and G to gather total and current flow rates. If these checks were to be reduced to once a week, it could save \$5,827 including fuel

2018 Case Study

CST Storage

Intern: Bhanuprakash Budamuagunta
Major: Mechanical Engineering
(Masters)
School: Wichita State University



Company background

CST Storage is a leading manufacturer and supplier of factory-coated steel storage tanks and aluminum storage tanks. CST was established in 1893 and its existing company portfolio consists of CST Storage, CST Covers and Vulcan Tanks. Five manufacturing facilities and technical design centers, and multiple regional sales offices are located throughout North America and the United Kingdom. International offices are in Argentina, Australia, Brazil, India, Japan, Malaysia, Mexico, Singapore, South Africa, Spain, United Kingdom, United Arab Emirates and Vietnam.

Project background

CST storage is committed to continual improvement processes and environmental sustainability. The company has partnered with the Kansas State University Pollution Prevention Institute, or PPI, to host P2 interns since 2011. CST has implemented several intern projects and has been recognized twice in the last decade with the Kansas Pollution Prevention (P2) Awards.

The 2018 intern projects included a comprehensive study to compare the current liquid (solvent) coating process to a new a powder-coating process; installation of energy-monitoring devices to record performance losses,

perspective on new opportunities for reducing their environmental footprint, saving money and improving the health of the environment.

Projects reviewed for P2 potential

Liquid to powder coating process change

The first project at CST was to research the environmental impacts of switching from a liquid top-coat process to a powder-coating process. The facility, which had been using the traditional solvent-based liquid top-coating process in its paint line for surface finishing, is now enthusiastically looking at a conversion to powder. Making the conversion from liquid paint to powder paint would be a major financial and plant layout commitment for the facility. The intern prepared all the key comparisons between the two processes, documenting the potential differences in air pollutants, environmental health exposure and the financials.

Switching to a powder coating process would improve performance by 18 percent and provide an annual savings of about \$850,000 dollars with a payback of one-year. In addition to the significant financial savings, the company would reduce about 49 tons per year of volatile organic compounds (VOCs) and 5 tons per year of combined hazardous air pollutants (HAPs).



Cumulative Data 2006-2019

88,889 MWh electricity

301,710 MMBTU natural gas

16,547 tons solid waste

382 million gallons of water

241 tons of chemical replacement

\$14,603,174

83,568 MTCO₂e



Application Process and Intern Schedule

- August through December 31: Host company applications can be submitted to PPI – Online applications
- February: PPI interview's and select interns, pair w/host companies
- Third week of May – Intern training on P2 Strategies
- Late May – Early Aug.: Interns with host companies
 - Interns produce a detailed report of the internship findings
 - Interns produce case summary of their projects and findings - online
 - Interns presentations of their findings in September



Questions?



Contact Lynelle Ladd

Applications:
<http://www.ksuppi.org/intern-program>

KSU-PPI@ksu.edu
800.578.8898

